GEORGIA INSTITUTE OF TECHNOLOGY
OFFICE OF CONTRACT ADMINISTRATION
SPONSORED PROJECT INITIATION

Date: December 5, 1979

Project Title: Training Program in Hazardous Waste Management

Project No: E-20-549

Project Director: Dr. F. G. Pohland

Sponsor: U. S. Environmental Protection Agency

Agreement Period: From 11/1/79 Until ~~10/31/80~~ 8/30/82 ~~6/30/82~~ ~~12/31/81~~ ~~9/30/81~~ ~~11/30/81~~ ~~1/31/81~~

Type Agreement: Training Grant No. T901070010

Amount: $29,000 (EPA)
10,388 (GIT) E-20-219
$39,388 Total

Reports Required: Quarterly Progress Rpts.; Quarterly Financial Rpts.; Final Rpt.; Final Financial Rpt.

Sponsor Contact Person (s):

Technical Matters

Project Officer
Gladys L. Harris
Office of Solid Waste
(WH-562)
Environmental Protection Agency
Washington, D. C. 20460

Contractual Matters
(thru OCA)

Defense Priority Rating: n/a

Assigned to: Civil Engineering (School/Laboratory)

COPIES TO:

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CA–3 (3/76)

GEORGIA INSTITUTE OF TECHNOLOGY OFFICE OF CONTRACT ADMINISTRATION

SPONSORED PROJECT TERMINATION SHEET

SR205

Date 11/12/82

Project Title: Training Program in Hazardous Waste Management

Project No: E-20-549

Project Director: Dr. F. C. Pohland

Sponsor: US EPA

Effective Termination Date: 9/30/82

Clearance of Accounting Charges: 9/30/82

Grant/Contract Closeout Actions Remaining:

- ☐ Final Invoice and Closing Documents
- ☒ Final Fiscal Report (Form SF-269) (to Grants Officer)
- ☒ Final Report of Inventions (to Grants Officer)
- ☒ Govt. Property Inventory & Related Certificate (to Program Officer)
- ☐ Classified Material Certificate
- ☐ Other _____

Assigned to: CE (School/~~Laboratory~~)

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SCEGIT-82-111 October 1982

TRAINING PROGRAM IN HAZARDOUS WASTE MANAGEMENT

by

Frederick G. Pohland
School of Civil Engineering
Georgia Institute of Technology
Atlanta, Georgia 30332

Grant No. T901070

Project Officer

Carol S. Lawson
Office of Solid Waste and Environmental Response
U. S. Environmental Protection Agency
Washington, D.C. 20460

TECHNICAL INFORMATION AND COMMUNICATION BRANCH
OFFICE OF SOLID WASTE AND EMERGENCY RESPONSE
U. S. ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D. C. 20460

CONTENTS

TABLES

SECTION 1

INTRODUCTION

Recognizing the continued criticality of technology transfer and the need to develop a responsive and technically capable pool of trained personnel in the area of solid and hazardous waste management, an academic training program was undertaken to further develop and strengthen the solid and hazardous waste management thrust within Environmental Engineering at the Georgia Institute of Technology. The training effort was conceived to augment existing program initiatives and to provide:

- a degree program for engineers and scientists at the post-bacculaureate level with a hazardous waste management specialty; and,

- a series of special courses, symposia and training materials available not only to students pursuing degree programs, but to both entry level and practicing professionals already engaged in hazardous waste management.

Although support for this expanded training effort was moderate, it served to catalyze other activities and to provide a basis for development of a special focus on hazardous waste management within the Environmental Engineering program through course development, research and complementary professional activities. These added benefits are described in the following narrative and cover the period from project initiation on November 1, 1979 to the present.

SECTION 2

SUMMARY AND RECOMMENDATIONS

A one-year training grant from the U.S. Environmental Protection Agency has provided the impetus for a more formalized emphasis on hazardous waste management within the Environmental Engineering Program at the Georgia Institute of Technology. Through this assistance and complementary support from the School of Civil Engineering, several important activities have been initiated over a project period eventually extended to three years. These activities embraced both formal training and research as well as service functions and included the following major accomplishments:

- development of a formalized and integrated graduate course sequence in solid and hazardous waste management consequenced by revision of two existing courses and the introduction of a new course specifically devoted to hazardous waste management;

- development of research and investigative initiatives leading to the preparation of eight special research reports and six publications appearing in the technical literature;

- training of a total of 50 graduate students selecting solid and hazardous waste management as a specialty area within their study and research programs;

- preliminary development of a self-study manual on hazardous waste management earmarked for entry level personnel; and,

- presentation of a symposium on hazardous waste management as a pilot effort for development of a routinely scheduled series.

Considering the moderate level of support and the relatively short time spent to accomplish the objectives of the training program, the results collectively indicate a very good return on the investment. Moreover, this initial effort has served to catalyze continuing development of the overall training effort which necessarily will also continue to impact favorably on the growth of a pool of qualified solid and hazardous waste management personnel. To augment this effort, it is recommended that these results be amalgamated with the results of similar training programs elsewhere so that the most productive and beneficial features of each can be made more visible and available. A seminar/symposium devoted to such a topic would be highly beneficial to both the educational and practicing communities.

As with all newer areas of environmental concern, the recent focus on hazardous waste problems and their management has led to some confusion in the area of technology transfer particularly with regard to sufficiency of approach and keeping these approaches up to date with current developments. The vast number and variety of short courses and specialty conferences are suggestive of a good deal of uncertainty regarding state-of-the-art technology and/or its implementation in the area of solid and hazardous waste management. Moreover, guidance is needed to interpret and properly implement existing and emerging regulations in both the private and public sectors. Therefore, a coupling of the regulatory and technical issues as is proposed herein by the development of training manuals, symposia, and other educational devices is considered an approach worthy of further inspection and support by government as well as the user community. A logical first step in this direction would again be a review and summary of the results of EPA training programs initiative, either by the agency or one of the participants, to be then shared as a resource and basis for exploration of possible further extension of the training effort.

SECTION 3

TRAINING PROGRAM APPROACH AND ACCOMPLISHMENTS

As indicated in the introduction to this report, problems associated with solid and hazardous wastes have become increasingly apparent and the passage of the Resource Conservation and Recovery Act and the Comprehensive Environmental Response, Compensation, and Liability Act (Superfund) together with their associated mandates for control over hazardous wastes has provided focus on a correspondingly critical manpower need. This need has been addressed by the subject training by coupling such a thrust with an already established Environmental Engineering program.

CURRICULA, RESEARCH AND PROGRAM PRODUCTIVITY

To appropriately structure the emphasis on hazardous waste management within the existing academic curriculum, an initial review and revision of certain courses was undertaken. This activity resulted in the development and presentation of a three-course sequence in solid and hazardous waste management. The content outlines and emphasis for these courses are presented in Appendix A; the former two solid waste technology courses resulted from a revision of an existing two-course sequence at the graduate level, the latter course was introduced as a new graduate level course on hazardous waste management. Announcements for these courses have appeared routinely in catalogue, brochure and/or registration materials or in special announcements as typlified by the notification included in Appendix B.

Although these courses were made separately available to any qualified students, they most generally were included as specialty areas within both designated and undesignated degree programs within Environmental Engineering. Hence, science students without engineering backgrounds would develop their curricula toward receipt of an undesignated M.S. degree in Environmental Engineering. Students with engineering backgrounds would generally opt for a designated M.S. in Environmental Engineering. In addition, a requirement of including at least one of these courses in the study programs of all Ph.D. candidates has been instituted.

In the case of both M.S. and Ph.D. students, the solid and hazardous waste management emphasis is reflected in the individual programs of study as well as in special problem and research projects. Such a program of study for a designated M.S. degree in Environmental Engineering would typically require one year of effort and include the following courses and credit hours:

Fall Quarter

*CE 4148	Application of Microbiology in Environmental Engineering	3-0-3
*CE 4142	Environmental Microbiology Laboratory	1-3-2
*CE 6102	Physical Principles in Environmental Engineering	3-0-3
CE 6126	Introduction to Air Pollution	3-0-3
*CE 6136	Applications of Chemistry in Environmental Engineering	3-0-3
*CE 6137	Fundamentals of Chemical Analysis in Environmental Engineering	1-3-2
		16 hrs.

Winter Quarter

CE 6105	Applications of Instrumental Methods in Environmental Engineering	2-3-3
**CE 6118	Solid Waste Technology I	2-3-3
*CE 6140	Environmental Engineering Processes I	4-0-4
*CE 6141	Environmental Engineering Processes II	4-0-4
		14 hrs.

Spring Quarter

*CE 6113	Industrial Waste Treatment and Disposal	3-0-3
CE 6120	Treatment and Disposal of Residues	3-0-3
**CE 6128	Solid Waste Technology II	2-3-3
*CE 6142	Environmental Engineering Processes III	3-0-3
*CE 8002	Seminar in Environmental Engineering	0-2-1
		13 hrs.

Summer Quarter

**CE 6115	Hazardous Waste Management	2-3-3
*CE 6116	Environmental Engineering Processes Laboratory	1-6-3
CE 8003	Research Seminar in Environmental Engineering	1-0-1
*CE 8756	Master's Special Research Problem	- -6
		13 hrs.

*Required core course for designated M.S. in Environmental Engineering.
**New or revised course in solid and hazardous waste management.

For those students choosing to include the solid and hazardous waste management option within their academic program, the special research problems were devoted to investigation of complementary problem areas. As a consequence, several M.S. Special Problem reports have been or are in the process of being completed during the training project period. These have been included in Table 1

TABLE 1. M.S. SPECIAL RESEARCH PROBLEM REPORTS

Student	Title	Date
James C. Strait, Jr.	Sanitary Landfill Disposal of a Liquid Hazardous Waste Admixtures	November 1979
Rodney G. Kutz	Hazardous Waste Evaluation of Aluminum Finishing Sludges	November 1980
Joan B. Boilen	Hazardous Waste Manual	March 1981
Winston R. Esteves	Effectiveness of Leachate Recycle in the Stabilization of Municipal Solid Waste When Co-Disposed with Hazardous Industrial Wastes	September 1981
Bruce J. Spiller	Co-Disposal of Metal Finishing Sludge and Municipal Solid Wastes	March 1982
R. Elizabeth Ramsey	Identification and Assessment of Effluent Residuals in Treated Leachate from Landfill Disposal Sites	In Preparation

In addition to these individual student efforts, a major final research report, "Controlled Landfill Stabilization by Leachate Recycle" has been submitted for review (September 1982) to the grantee, the U. S. Environmental Protection Agency (EPA). This research project together with four other current projects ("The Use of Plastic Foam as a Cover Material During Landfilling of Solid Wastes", Sanifoam, Inc.; "Critical Review and Summary of Leachate and Gas Prdouction from Landfills", EPA; "Co-Disposal of Low Level Radioactive Wastes Within Sanitary Landfills, DOE; and, "Fate of Heavy Metals During Landfill Stabilization of Solid Waste Materials with Leachate Recycle, EPA.) have and continue to provide a focus and student support for study and research in the area of solid and hazardous waste management.

These research efforts have also led to the publication of one Ph.D. thesis on "Co-Disposal of Low Level Radioactive Wastes Within Sanitary Landfills" (Ker-Chi Chang, September 1982) and several presentations and contributions to the technical literature. These latter efforts have included the following pertinent publications.

Pohland, F. G. and Gould, J. P., "Stabilization of Municipal Landfills Containing Industrial Wastes", Proc. 6th Annual Research Symposium: Disposal of Hazardous Waste, EPA-600/9-80-010, 242 (1980).

Pohland, F. G., "Leachate Recycle as a Landfill Management Option", Jour. Environmental Engineering Div., ASCE, 106, EE6, 1057 (1980).

Pohland, F. G., "Leachate Collection and Recycle as a Landfill Management Option (In German), Proc. Waste Management Seminar, Technischen Universitat Berlin, 374 (1980).

Pohland, F. G., Gould, J. P., Ramsey, R. E., Spiller, B. J. and Esteves, W. R., "Containment of Heavy Metals in Landfills with Leachate Recycle", Proc. 7th AnnualResearch Symposium on Landfill Disposal: Municipal Solid Wastes, EPA-600/9-81-002a, 179 (1981).

Gould, J. P., Ramsey, R. E., Giabbai, M. and Pohland, F. G., "Formation of Volatile Haloorganic Compounds in the Chlorination of Municipal Landfill Leachates", in Water Chlorination: Environmental Impacts and Health Effects, Vol. 4, Chap. 36, 525, Ann Arbor Science, 1982.

Chang, K. C., Chian, E. S. K., Pohland, F. G., Kahn, B., Cross, W. H. and Roland, L., "Codisposal of Low-Level Radiowactive Wastes Within Sanitary Landfills", Proc. 1982 National Conference on Environmental Engineering, ASCE, 325, 1982.

The total student involvement encouraged by the training program in hazardous waste management has been reflected by not only their identification with research and publications but by their formal enrollment in the three-course solid and hazardous waste management sequence. The identity of these students and their participation in the courses are indicated in Table 2.

During the period recorded in Table 2, CE 6115 was introduced and presented twice, CE 6118 was presented three times and CE 6128 was presented only once. The number of times offered was dependent upon enrollments; the first course of the sequence (CE 6118) being more often presented and capable of being accommodated by the various student programs although the hazardous waste management course (CE 6115) has now emerged as a relatively attractive offering. During this same period, three graduate students (Dertien, Walters and Williams) and one undergraduate student (M. Deiters) were supported directly by the training grant in their studies and research activities. Considering the magnitude and longivity of support, this record of student involvement, course development and research is considered to be very favorable.

TABLE 2. STUDENT PARTICIPATION IN SOLID AND HAZARDOUS WASTE MANAGEMENT COURSES; 1980-1982

Student	CE 6115	CE 6118	CE 6128
Chang, Ker-Chi (Ph.D.)		X	
Chen, Ben (M.S.)	X		
Cheng, Sheng S. (Ph.D.)		X	
Chin, David A. (M.S.)	X	X	
Dertien, Joseph T. (M.S.)	X	X	X
DeSousa, Fernando (M.S.)	X		
Elmendorf, Holly A. (M.S.)	X		
Esteves, Winston R. (M.S.)		X	
Fitchhorn, Larry E (M.S.)	X		
Farfunkel, Wayne I. (M.S.)		X	
Gee, Chai Sung (M.S.)		X	
Ghosh, Sarba B. (Ph.D.)	X		
Graven, Johannes T (Ph.D.)	X	X	X
Grubbs, Thomas R. (M.S.)	X	X	X
Harmon, C. Blake (M.S.)		X	
Hay, Tyler R. (M.S.)		X	
Hayes, Kimberly A. (M.S.)		X	
Heiner, Lilyann A. (M.S.)		X	
Henrique, Jose (M.S.)	X		
Hicks, Marlow (M.S.)		X	
Kharkar, Salil M. (M.S.)		X	
Kratz, Kurt (M.S.)	X		
Kutz, Rodney G. (M.S.)	X		
Lin, Yia-Sin (M.S.)			X
Medero, Gallart J. (M.S.)	X	X	
Michlin, Lee A. (M.S.)		X	
Minchew, Eddie P. (Ph.D.)		X	
Montgomery, Terry L. (M.S.)		X	
Moore, William L. (M.S.)		X	
Mullinax, Edmund L. (M.S.)		X	
O'Neil, John P. (Ph.D.)		X	
Palazzolo, Rocco M. (M.S.)		X	X
Ramsey, Ruth E. (M.S.)	X	X	
Rollor, Michael A. (Ph.D.)		X	
Rosello, Pedro (M.S.)	X		
Runyan, Michael (M.S.)		X	
Salgaankar, Jagdish (M.S.)	X		
Shah, Sunil I. (Ph.D.)	X		
Smith, Mark O. (M.S.		X	
Spiller, Bruce J. (M.S.)	X	X	

(continued)

TABLE 2 (continued)

Student	CE 6115	CE 6118	CE 6128
Starkey, John E. (M.S.)		X	
Tendler, Judith L (M.S.)		X	
Tillman, Matthey (M.S.)		X	
Walters, Daniell C. (M.S.)		X	
Vaughn, Gary D. (M.S.)		X	
Wei, Lian-Pany (M.S.)		X	
Whalen, Kelly J. (M.S.)		X	
Williams, Tyronce C. (M.S.)	X		
Wu, Tak Pu (M.S.)		X	
	19	37	5

CE 6115; Hazardous Waste Management, 2-3-3
CE 6118; Solid Waste Technology I, 2-3-3
CE 6128; Solid Waste Technology II, 2-3-3

TRAINING FACILITIES AND MATERIALS

Complementary to the formal teaching and research activities has been the development of facilities and training materials. Included as support facilities were both laboratory and pilot-scale systems for investigations and demonstration of analytical techniques and processes associated with the management of solid and hazardous wastes particularly with regard to land disposal. This latter emphasis was augmented by the availability of several lysimeter-type and pilot-scale landfills for the study of the behavior and environmental impact of waste materials deposited on or in the land.

In addition to routine laboratory equipment and methods, students emphasizing solid and hazardous waste management in their study and research programs were given access to sophisticated instrumental techniques available within the Environmental Engineering program, including:

- Gas Chromatographs with flame ionization, thermal conductivity and electron capture detectors and associated appurtenances;
- Liquid chromatograph with UV-VIS, RI and Electro-Chemical detectors;
- Atomic Absorption Spectrophotometer with flame and graphite furnace and cold vapor (mercury) and hydride (arsenic and selenium) generation systems;
- Mass Spectrometer with software programs and library for matching spectra;
- Carbon Analyzers with low-level purgeable, boat and syringe injection inlets;
- Carbon, Hydrogen and Nitrogen Analyzer;
- Auto-Analyzer with visible and fluorescence detectors;
- UV-VIS Spectrophotometer with dual beam, ratio recording;
- IR Spectrophotometer; and,
- Oxygen Bomb Calorimeter.

As a special goal and product of the training effort, the development of a hazardous waste management manual was initiated. This manual is being developed as a self-study resource to be used to supplement the training effort within Environmental Engineering, to provide a resource supportive of future seminars and/or symposia and to deliver to the profession a basic information document to be used by entry level personnel. A preliminary draft of this manual has been completed and utilized to satisfy M.S. requirements of one of the graduate students participating in the program (Boilen,

Table 1). This initial effort is being continued with a revised format to accommodate new regulatory initiatives, i.e., Superfund and the recently proposed EPA land disposal regulations. It was the delay in the formalization of these latter activities that resulted in a project extension beyond the original one-year authorization and termination date of October 1980. Since final promulgation of the latter land disposal regulations is not scheduled until January 1983, completion of the final edition of the manual has been postponed until early 1983. However, much of the effort has been completed according to the tentative outline presented in Appendix C.

HAZARDOUS WASTE MANAGEMENT SYMPOSIUM

To assist in the development and visibility of the training effort, a three-day Symposium on Hazardous Waste Management, originally scheduled for March 1981, was eventually held on the campus of the Georgia Institute of Technology in September 1981. This symposium was formulated to provide particular emphasis on the technical aspects of hazardous waste management including the impact of current regulatory issues and their implementation with topics being prepared and presented by experienced individuals from both the public and private sectors. As such, it provided not only a forum for information exchange, but an identity of currently available resources and sources of information on hazardous waste management.

The symposium was specifically designed for individuals seeking a foundation in current regulatory, management and operational aspects of hazardous waste control. Hence, participants from both the industrial and municipal sectors having responsibility for implementation of hazardous waste management as well as representatives of the public were in attendance. A special invitation with complimentary registration was tendered to representatives of state regulatory agencies in the Southeast and the registration fees were kept at a minimum ($35) by supplementation from the training grant. To permit a more personal classroom-type setting, registration was limited to 50 participants.

Since the symposium was conducted as part of the continuing education effort at Georgia Tech, continuing education units (1.2 CEU) and a certificate were awarded each registrant who attended throughout the entire instructional period. These were prepared for the 50 participants and special appreciation was extended to the symposium staff. Their identities together with the topics presented and an example of the attendance certificate are presented with the materials included in Appendix D.

The symposium effort is intended to be continued on a routine basis, possibly as a forum for determining the effectiveness of the Hazardous Waste Management Manual as it becomes available. Moreover, the availability of the manual may promote its use in more formalized correspondence courses or by other groups and/or training institutions. Hence, it is recognized that the manual must be as contemporary a document as possible with the flexibility to facilitate periodic revision, and modification and/or updating. These issues will be addressed as the final publication format is established.

APPENDIX A

COURSE OUTLINES

CE 6115
HAZARDOUS WASTE MANAGEMENT
(2-3-3)

Lecture Topic No.

1. Sources and Characteristics of Hazardous Wastes
   - Classification
   - Health Hazards and Toxicology
   - Sources

2. Handling and Transportation Requirements
   - Inventory and Manifest Systems
   - Personal Safety and Protective Equipment
   - Shipping Containers and Vehicle Requirements

3. Hazardous Material Spills
   - Prevention
   - Clean-up and Treatment
   - Emergency Response

4. Monitoring and Analyses
   - Analytical and Instrumental Methods
   - Data and Environmental Impact Analysis
   - Standards and Com;liance Requirements

5. Treatment and Disposal
   - Source Reduction and Process Modification
   - On-Site Treatment and Storage
   - Waste Exchange
   - Incineration
   - Land Treatment
   - Ultimate Disposal

6. Statutes, Regulatory Guideline and Implementation Procedures
   - Federal Legislation and Responsibilities
   - State Laws and Responsibilities
   - Public Participation
   - Enforcement

Laboratory Topic No.

1. Introduction to General Laboratory Procedures, Laboratory Safety and Precautions

2. Methods of Hazardous Waste Sampling and Sample Preparation

3. Industrial Field Trip and Waste Acquisition

Laboratory Topic No.

4.	Analytical Methods for Characterizing Hazardous Wastes; Toxicity, Corrosivity, Ignitability and Reactivity
5.	Special Analytical Techniques and Waste Characterization Analyses
6.	Data Compilation, Evaluation and Presentation
6.	Data Compilation, Evaluation and Presentation

Text: Appropriate handouts will be distributed.

CE 6118
SOLID WASTE TECHNOLOGY I
(2-3-3)

Lecture Topic No.		Assignment*
1.	Introduction and General Perspective	Chap. 1, Appendix A
2.	Sources, Quantities and Composition of Solid Wastes Definition of categories Sources and types Generation rates Composition	Chap. 4
3.	On-Site Handling, Storage and Processing Public health and aesthetics Handling and storage Processing methods Management	Chap. 5 and Chap. 13
4.	Collection Methods Systems, equipment and labor requirements Analysis techniques Routing Administration	Chap. 6 and Chap. 14
5.	Transfer Operations Transfer stations Transfer systems Management	Chap. 7 and Chap. 15
6.	Processing Techniques and Equipment Volume reduction Separation Drying and dewatering Management	Chap. 8 and Chap. 16
7.	Resource Recovery and Conservation Materials processing and recovery systems Recovery of conversion products Materials and energy balances Management	Chap. 9 and Chap. 16
8.	Ultimate Disposal Practices Site selection and development Landfilling methods and operations Gas and leachate movement and control Ocean disposal Management	Chap. 10 and Chap. 17

Lecture Topic No.		Assignment*
9.	Hazardous Wastes Identification and classification Generation and regulation Storage, collection and transport Processing Management	Chap. 11 and Chap. 17
10.	Planning and Management Issues and Special Topics	Chaps. 12, 17 and 18

Laboratory Topic No.

1. Introduction to Laboratory Activities

2. Sampling Procedures
   - Methods
   - Categories and quantities
   - Preparation and storage

3. Analytical Procedures
   - Methods of analysis
   - Instrumentation and laboratory safety
   - Specific analyses (moisture, solids, N, P, X, nutrients, CHN, pH, calorific value, etc.)

4. Field Inspections
   - Incinerator
   - Shredding plant and transfer operations
   - Sanitary landfill

*Text: Solid Wastes-Engineering Principles and Management Issues, Tchobanoglous, G., Theisen, H. and Eliassen, R., McGraw-Hill Book Company, New York, 1977.

Additional References:

1. Municipal Solid Waste Collection, National Center for Resource Recovery, Inc., Lexington Books, Lexington, Mass., 1973.

2. Sanitary Landfill, National Center for Resource Recovery, Inc., Lexington Books, Lexington, Mass., 1974.

3. Incineration, National Center for Resource Recovery, Inc., Lexington Books, Lexington, Mass., 1974.

4. Resource Recovery from Municipal Solid Waste, National Center for Resource Recovery, Inc., Lexington Books, Lexington, Mass., 1974.

5. Handbook of Solid Waste Disposal, Pavoni, J. L., Heer, J. E., Jr., and Hagerty, D. J., VanNostrand Reinhold Company, New York, 1975.

6. Standard Methods, APHA, 14th Edition, 1975.

CE 6128
SOLID WASTE TECHNOLOGY II
(2-3-3)

Lecture Topic No.		Assignment*
1.	Introduction and General Perspective	
2.	Review of Solid Waste Characteristics and Quantities	Tchobanoglous, et al., Chap. 4
3.	Characteristics of Processing Disposal Systems Composting Incineration Sanitary Landfilling	Tchobanoglous, et al., Chaps. 9 and 10 Corey and ASCE
4.	Principles of Design of Processing and Disposal Systems Composting Incineration Sanitary Landfilling	Tchobanoglous, et al., Corey and ASCE
5.	New Methods and Advanced Topics Research developments Demonstration projects New equipment and methods	

Laboratory Topic No.

1. Introduction to Laboratory Activities
2. Design Assignments (coordinated with lecture schedule)
   - Composting
   - Incineration
   - Sanitary Landfills
3. Evaluation of Local Solid Waste Management System
4. Report Presentations on Laboratory Design Problems
5. Field Inspection of Resource Recovery System

*Texts: Solid Wastes - Engineering Principles and Management Issues, McGraw-Hill Book Company, New York, 1977

Principles and Practices of Incineration, Corey, R. C., Wiley-Interscience, New York, 1969

Sanitary Landfill, ASCE Manual of Practice No. 39, 1959

APPENDIX B

COURSE ANNOUNCEMENT

COURSE ANNOUNCEMENT

SUMMER QUARTER 1980

CE 8113A, HAZARDOUS WASTE MANAGEMENT, 2-3-3

INTRODUCTION TO HAZARDOUS WASTE MANAGEMENT WITH SPECIAL EMPHASIS ON SOURCES AND CHARACTERISTICS, TRANSPORATION, TREATMENT AND DISPOSAL. MANAGEMENT APPROACHES WILL BE SUPPLEMENTED BY ANALYTICAL METHODS USED TO MEASURE AND MONITOR POTENTIAL ENVIRONMENTAL IMPACTS AND BY A REVIEW OF CURRENT LAWS, REGULATIONS AND COMPLIANCE PROCEDURES.

INSTRUCTOR: DR. F. G. POHLAND, (404)894-2265
ROOM 355, DANIEL LABORATORY BUILDING
GEORGIA INSTITUTE OF TECHNOLOGY
ATLANTA, GEORGIA 30332

TIME: WEDNESDAY AND FRIDAY, 11:00 AM
TUESDAY, 1:00-4:00 PM

PREREQUISITE: CONSENT OF INSTRUCTOR

APPENDIX C

TENTATIVE OUTLINE OF HAZARDOUS WASTE MANAGEMENT MANUAL

Tentative Outline

HAZARDOUS WASTE MANAGEMENT MANUAL

SECTION 1

1.0 Introduction

- 1.1 Purpose and Use of Manual
- 1.2 General Perspective of the Hazardous Waste Problem
- 1.3 Resource Requirements

SECTION 2

2.0 Legislative Initiatives and Regulatory Framework

- 2.1 Synopsis
- 2.2 Resource Conservation and Recovery Act
  - 2.2.1 Scope
  - 2.2.2 Identification and Listing of Hazardous Wastes
  - 2.2.3 Identification and Notification of Hazardous Waste Management Activities and Facilities
  - 2.2.4 Program Implementation, Inspection and Enforcement
  - 2.2.5 Amendments and Emerging Legislation
- 2.3 Clean Water Act
  - 2.3.1 Scope
  - 2.3.2 Pretreatment Requirements
  - 2.3.3 Toxic Effluent Standards
  - 2.3.4 Designation and Determination of Hazardous Substances
  - 2.3.5 Administration and Enforcement
- 2.4 Toxic Substances Control Act
  - 2.4.1 Scope
  - 2.4.2 Chemical Imports and Exports
  - 2.4.3 Inventory Reporting Regulations
  - 2.4.4 Waste Management
  - 2.4.5 Administration and Enforcement
- 2.5 Safe Drinking Water Act of 1974
  - 2.5.1 Scope
  - 2.5.2 Drinking Water Standards
  - 2.5.3 Underground Injection Control Program
  - 2.5.4 Administration and Enforcement
- 2.6 The Rivers and Harbors Act of 1899
  - 2.6.1 Scope
  - 2.6.2 Administration and Enforcement

SECTION 2 (continued)

2.7 Department of Transportation Rules

2.7.1 Scope
2.7.2 Identification of Hazardous Wastes and Hazardous Substances
2.7.3 Packaging and Shipping Requirements
2.7.4 Container and Vehicle Specifications
2.7.5 Administration and Enforcement

2.8 Comprehensive Environmental Response, Compensation and Liability Act of 1980 (Superfund)

2.8.1 Scope
2.8.2 National Contingency Plan
2.8.3 Administration

2.9 Other

SECTION 3

3.0 Hazardous Waste Management Procedures and Responsibilities

3.1 Hazardous Waste Generators

3.1.1 Synopsis
3.1.2 RCRA Requirements
3.1.3 Implementing Regulations and Procedures

3.2 Hazardous Waste Transporters

3.2.1 Synopsis
3.2.2 RCRA Requirements
3.2.3 DOT Requirements
3.2.4 Implementing Regulations and Procedures

3.3 Owners of Hazardous Waste Treatment, Storage and Disposal Facilities

3.3.1 Synopsis
3.3.2 RCRA Requirements
3.3.3 Implementing Regulations and Procedures

3.4 State Programs

3.4.1 Synopsis
3.4.2 RCRA Authorization
3.4.3 Implementing Regulations and Agreements
3.4.4 Current Status

3.5 Public Participation

3.5.1 Synopsis
3.5.2 RCRA Requirements
3.5.3 Implementing Procedures
3.5.4 Potential Participants

SECTION 3 (continued)

SECTION 4

SECTION 5

5.0 Treatment, Storage and Disposal of Hazardous Waste

5.1 Introduction

5.1.1 Scope and Rationale
5.1.2 Selection Procedures
5.1.3 Information Sources

5.2 Treatment Alternatives

5.2.1 Synopsis
5.2.2 Pretreatment Options
5.2.3 Separate Treatment Options
5.2.4 Operational Considerations
5.2.5 Monitoring and Control

5.3 Storage Alternatives

5.3.1 Synopsis
5.3.2 On-Site Options
5.3.3 Off-Site Options
5.3.4 Operational Considerations
5.3.5 Monitoring and Control

5.4 Disposal Alternatives

5.4.1 Synopsis
5.4.2 Land Disposal
5.4.3 Ocean Disposal
5.4.4 Deep Well Injection
5.4.5 Operational Considerations
5.4.6 Monitoring and Control

SECTION 6

6.0 Hazardous Waste Contingency Plans and Emergency Response

6.1 Contingency Planning

6.1.1 Synopsis
6.1.2 Plan Organization
6.1.3 Responsibilities
6.1.4 Implementation and Monitoring

6.2 Emergency Response

6.2.1 Synopsis
6.2.2 Sources of Information and Assistance
6.2.3 Responsibilities
6.2.4 Implementation
6.2.5 Current Status

APPENDIX D

ANNOUNCEMENTS, ROSTER, AND ATTENDANCE CERTIFICATE FOR SYMPOSIUM ON HAZARDOUS WASTE MANAGEMENT

SYMPOSIUM ON HAZARDOUS WASTE MANAGEMENT
March 25-27, 1981

PROGRAM

Wednesday, March 25, 1981

8:00 a.m. Registration - Continuing Education

Morning Session Presiding - Frederick G. Pohland

8:30 a.m. Welcome and Introduction
9:00 a.m. Hazardous Waste Problem in Perspective - Joan B. Boilen
10:00 a.m. Coffee - Refreshments
10:15 a.m. The Regulatory Framework for Controlling Hazardous Wastes - Frederick G. Pohland
12:15 p.m. Lunch

Afternoon Session Presiding - Joan B. Boilen

1:15 p.m. Implementation of Hazardous Waste Programs at the State Level - John D. Taylor, Jr.
2:45 p.m. Coffee - Refreshments
3:00 p.m. Public Participation - Jane P. MacGregor
4:00 p.m. Site Inspections - Wayne R. Mathis
5:00 p.m. Adjourn

Thursday, March 26, 1981

Morning Session Presiding - Edward S.K. Chian

8:30 a.m. Characteristics of Hazardous Wastes; Chemical Principles and Toxicology - Mark A. McClanahan
10:00 a.m. Coffee - Refreshments
10:15 a.m. Hazardous Waste Sampling and Analytical Procedures - Wendall H. Cross
11:15 a.m. Handling and Transport Considerations - Charles E. Ramsey
12:15 p.m. Lunch

Afternoon Session Presiding - Frederick G. Pohland

1:15 p.m. Hazardous Waste Management; On-Site Storage and Treatment - F. Michael Saunders
2:45 p.m. Coffee - Refreshments
3:00 p.m. Hazardous Waste Management; Disposal - Frederick G. Pohland
5:00 p.m. Adjourn

Friday, March 27, 1981

Morning Session Presiding - Byung R. Kim

8:30 a.m. In-Plant Audit and Hazardous Waste Survey - George J. Hyfantis, Jr.
10:00 a.m. Coffee - Refreshments
10:15 a.m. Spills, Cleanup and Emergency Response - Doye B. Cox
12:15 p.m. Lunch

Afternoon Session Presiding - Frederick G. Pohland

1:15 p.m. Panel Discussion and Review - Symposium Participants
3:00 p.m. Adjourn

Symposium Description

This symposium has been developed by the School of Civil Engineering at Georgia Institute of Technology with training grant support from the U. S. Environmental Protection Agency. The symposium will place major emphasis on the technical aspects of hazardous waste management including the impact of current regulatory issues and their implementation. Formal presentations on: the regulatory framework; implementation of State programs; public participation; site inspections; hazardous waste characterization; sampling and analysis; handling and transport; on-site storage and treatment methodologies; disposal options; in-plant audits and surveys; and, spills, cleanup and emergency response will augment resource materials to be made available at the symposium. The topics will be presented by symposium participants actively engaged in hazardous waste management within both the public and private sectors.

Symposium Objectives

This symposium is intended to:

- Identify issues and problems related to hazardous waste management;
- Serve as a forum for information exchange on the technology of hazardous waste management; and,
- Make available current resources and sources of information on hazardous waste management.

Who Should Attend

This symposium has been specifically designed for individuals seeking a foundation in current regulatory, management and operational aspects of hazardous waste control. This includes both industrial and municipal personnel who have some responsibility for implementation of hazardous waste management programs. Since it is planned to present the symposium within a classroom-type setting, registration will be limited to a relatively small group. Therefore, early registration is recommended.

Eligibility and Fees

The symposium fee is $50.00 which includes refreshment breaks and instructional materials. Georgia Tech students and staff may attend at a reduced fee on a space-available basis. Printed materials and resource documents will be made available for many of the presentations.

The registration covers the entire symposium and should be made as far in advance as possible. Although registration will be limited, it will be accepted at the time of the symposium if space is available. The registration fee should be included with the registration application. A full refund of fee will be allowed if registration is cancelled in advance or if the symposium is not held.

SYMPOSIUM PARTICIPANTS

Ms. Joan B. Boilen
U.S. Environmental Protection Agency

Dr. Edward S. K. Chian
Georgia Institute of Technology

Mr. Doye B. Cox
Tennessee Valley Authority

Dr. Wendall H. Cross
Georgia Institute of Technology

Dr. George J. Hyfantis, Jr.
Tennessee Valley Authority

Dr. Byung R. Kim
Georgia Institute of Technology

Mr. Wayne R. Mathis
U.S. Environmental Protection Agency

Ms. Jane P. MacGregor
League of Women Voters

Dr. Mark A. McClanahan
U.S. Environmental Protection Agency

Dr. Frederick G. Pohland
Georgia Institute of Technology

Mr. Charles E. Ramsey
U.S. Department of Transportation

Dr. F. Michael Saunders
Georgia Institute of Technology

Mr. John D. Taylor, Jr.
Georgia Department of Natural Resources

1.2 Continuing Education Units

The number of CEUs indicated above will be recorded in the name of each registrant who successfully completes the program. An official transcript of CEUs earned in Georgia Tech programs can be obtained from the registrar.

Parking

Parking permits valid in a designated parking area will be issued to registrants upon request; however, parking space is limited and cannot be guaranteed.

Housing and Meals

Hotel or motel reservations should be made directly by the registrant. Full information on nearby hotels and motels will be included in registration acknowledgements. Many are within convenient walking distance and the campus is near the center of the city.

Meals are available at reasonable prices in the campus dining facilities or nearby restaurants. A campus map with full instructions will be sent to all registrants upon acceptance for enrollment.

Application Form

March 27-29, 1981 Symposium on Hazardous Waste Management 1.2 CEUs

*Full Legal Name_____
Last First Middle

Organization_____ Position_____

Organization Address_____
(for all correspondence)

*County of Residence (if from Georgia)_____

Organization Phone_____ Home Phone_____

*Race/Ethnic Identification:

American Indian or Alaskan Native	___	Hispanic	___
Asian or Pacific Islander	___	White (not of Hispanic Origin)	___
Black (not of Hispanic Origin)	___	Other	___

*Age Classification
Under 22 ___ Over 55___
22-35 ___
36-55 ___

*Sex:
Female ___
Male ___

Course Fee: $50.00

Make check payable to the Georgia Institute of Technology
Mail check and application to:
Department of Continuing Education
Georgia Institute of Technology
Atlanta, GA 30332
Telephone: (404) 894-2400

___Check here if you intend to bring a car to the campus

NO PROCEEDINGS WILL BE PUBLISHED

*Necessary for Summary Reporting to the University System of Georgia, national, state and other governmental agencies.

SYMPOSIUM ON HAZARDOUS WASTE MANAGEMENT
September 23-25, 1981
Georgia Institute of Technology
Atlanta, Georgia

Wednesday, September 23, 1981

a.m. 11:00 Registration - Continuing Education Department

Session 1: Statutes, Regulatory Guidelines and Implementation
Presiding; Dr. Frederick G. Pohland, Georgia Institute of Technology

p.m. 1:00 The Federal Framework - Ms. Joan B. Boilen, Region IV, U.S. Environmental Protection Agency
3:00 Refreshments
3:15 State Programs - Mr. John D. Taylor, Jr., Georgia Department of Natural Resources, Environmental Protection Division
4:15 Public Participation - Ms. Jane P. MacGregor, League of Women Voters
5:15 Adjourn

Thursday, September 24, 1981

Session 2: Characterization and Handling Procedures
Presiding; Dr. Edward S. K. Chian, Georgia Institute of Technology

a.m. 8:30 Chemical Principles and Toxicology - Dr. Mark A. McClanahan, Region IV, U.S. Environmental Protection Agency
10:00 Refreshments
10:15 Sampling and Analytical Procedures - Dr. Wendall H. Cross, Georgia Institute of Technology
11:45 Lunch
p.m. 1:00 Spills, Cleanup and Emergency Response - Mr. Doye B. Cox, Tennessee Valley Authority
3:00 Refreshments
3:15 Site Inspections - Mr. Wayne R. Mathis, Region IV, U.S. Environmental Protection Agency
4:15 Waste Exchanges - Mr. James N. Parkman, Georgia Business and Industry Association
5:15 Adjourn

Friday, September 25, 1981

Session 3: Technological Considerations
Presiding; Dr. Byung R. Kim, Georgia Institute of Technology

a.m. 8:30 In-Plant Audit and Waste Surveys - Dr. George J. Hyfantis, Jr., Tennessee Valley Authority
10:00 Refreshments
10:15 On-Site Storage and Treatment Options - Dr. F. Michael Saunders, Georgia Institute of Technology
11:45 Lunch
p.m. 1:00 Transportation Considerations - Mr. Charles E. Ramsey, U.S. Department of Transportation
2:00 Incineration - Dr. W. Macon Sheppard, Engineering-Science, Inc.
3:00 Refreshments
3:15 Land Treatment and Ultimate Disposal - Dr. Frederick G. Pohland, Georgia Institute of Technology
5:15 Adjourn

SYMPOSIUM DESCRIPTION.

This symposium has been developed by Dr. Frederick G. Pohland of Civil Engineering at Georgia Institute of Technology with training grant support from the U. S. Environmental Protection Agency. The symposium will place major emphasis on the technical aspects of hazardous waste management including the impact of current regulatory issues and their implementation. Formal presentations will be made by individuals actively engaged in hazardous waste management within both the public and private sectors.

SYMPOSIUM OBJECTIVES.

This symposium is intended to:

- Identify issues and problems related to hazardous waste management;
- Serve as a forum for information exchange on the technology of hazardous waste management; and
- Make available sources of information on hazardous waste management.

WHO SHOULD ATTEND?

This symposium has been specifically designed for individuals seeking a foundation in current regulatory, managerial and operational aspects of hazardous waste analysis and control. Commercial, industrial and municipal personnel who have some responsibility for implementation of hazardous waste programs or providing supporting services will find it to be particularly advantageous. Since it is planned to present the symposium within a classroom-type setting, registration will be limited to a relatively small group. Therefore, early registration is recommended.

REGISTRATION.

The symposium fee is $35.00 which includes instructional materials and refreshments. Additional printed materials and other resource documents will be made available to augment many of the presentations.

The registration covers the entire symposium and should be made as far in advance as possible. Although registration will be limited, it will be accepted at the time of the symposium if space is available. The symposium fee should be included with the registration application. A full refund of fee will be allowed if registration is cancelled in advance or if the symposium is not held.

CONTINUING EDUCATION UNITS.

1.2 Continuing Education Units will be recorded in the name of each registrant who successfully completes the program. An official transcript of CEUs earned in Georgia Tech programs can be obtained from the registrar.

HOUSING, MEALS AND PARKING.

Hotel or motel reservations should be made directly by the registrant. Full information on nearby hotels and motels will be included in registration acknowledgements. Many are within convenient walking distances and the Georgia Tech campus is near downtown Atlanta.

Meals are available at reasonable prices in the campus dining facilities or nearby restaurants. Parking permits valid in a designated parking area will be issued to registrants who indicate they will drive a car to the campus. A campus map with full instructions will be sent to all registrants upon acceptance for enrollment.

APPLICATION FORM

September 23-25, 1981 Symposium on Hazardous Waste Management 1.2 CEUs

*Full Legal Name _____
Last First Middle

Organization _____ Position _____

Organization Address _____
(for all correspondence)

*County of Residence (if from Georgia) _____

Organization Phone _____ Home Phone _____

*Race/Ethnic Identification:

American Indian or Alaskan Native	___	Hispanic	___
Asian or Pacific Islander	___	White (not of Hispanic Origan	___
Black (not of Hispanic Origin)	___	Other	___

*Age Classification

Under 22	___	36-55	___
22-35	___	Over 55	___

*Sex:

Female	___
Male	___

Course Fee: $35.00
Registration Deadline: September 16, 1981

Mail Check and application to:
Department of Continuing Education
Georgia Institute of Technology
Atalnta, GA 30332
Telephone: (404) 894-2400

___Check here if you intend to bring a car to the campus

NO PROCEEDINGS WILL BE PUBLISHED

*Necessary for Summary Reporting to the University System of Georgia, national, state and other governmental agencies.

SYMPOSIUM ON HAZARDOUS WASTE MANAGEMENT
September 23-25, 1981
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The Georgia Institute of Technology

This is to certify that

has successfully completed the

SYMPOSIUM ON HAZARDOUS WASTE MANAGEMENT

conducted by the

Department of Continuing Education

Given at Atlanta, Georgia this 25th **day of** September **19**81

Director, Continuing Education

President